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A COMMUNITY-MONITORING PROGRAM SURROUNDING THE NEVADA TEST SITE: One year of experience

by

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INTRODUCTION

Since 1954, the U.S. Public Health Service and later the U.S. Environmental Protection Agency Laboratory in Las Vegas, Nevada, have been responsible for conducting a program of environmental radiation monitoring and public radiation safety associated with nuclear weapons tests conducted by the United States. The original interagency agreement assigning this responsibility was between the Atomic Energy Commission and the Public Health Service (Sanders et al., 1955), and in recent years has been between the U.S. Department of Energy and the Environmental Protection Agency's Environmental Monitoring Systems Laboratory in Las Vegas, Nevada (Black et al., 1982).

A recent major innovation in this long-term program has been the establishment of a network of Community Monitoring Stations in 15 offsite communities. The new network supplements existing networks operated for nearly three decades in these and other offsite communities. It differs from other networks in the continuing offsite radiation monitoring and public safety program in that it incorporates Federal, State, and local Government participation. This report reviews the history of offsite radiation surveillance leading to institution of the new network and describes the first year of experience with its equipment, methodology, and management as well as its impact on citizens of the communities involved.

PROGRAM HISTORY

In the 1950's nuclear tests were conducted in clusters, or series, that lasted for a few to several months. Like the atmospheric tests themselves, the offsite monitoring and public safety program was highly visible. The Public Health Service (PHS) divided the offsite area into zones, each having a community designated as zone headquarters. PHS officers from Federal, State, and local health departments were brought to Nevada for the duration of each test series, and one or two officers were assigned to each zone. These officers lived in the zone headquarters community, some bringing their families, and entered into the life of the community. This brought added visibility to the program, in which the officers were to operate air samplers, collect other environmental samples, set out and exchange dosimeters, take exposure rate readings during and after passage of radioactive debris, institute protective or preventive actions should these become necessary to protect public health, and keep the public informed of the testing schedule and the radiation levels detected (Sanders et al., 1955; Placak et al., 1957; Placak et al., 1958).

The United States conducted no tests between October 30, 1958, and September 15, 1961. Tests thereafter were conducted year round, rather than in operations of a few months duration. The PHS no longer assigned officers to live in zone communities, but operated out of its Southwestern Radiological Health Laboratory established in Las Vegas in 1959. They set up a permanent network of continuously operating air samplers, many of which were attended by local residents who changed filters daily and were paid a nominal amount for their time and for the power used to operate the sampler (Off-Site Radiological Safety Program, 1964).

Before, during, and after each nuclear test, PHS personnel were in the offsite area to take samples and make radiation exposure rate readings, to institute protective actions if needed, and to continue the public information program. They continued to address local groups and show films on nuclear testing, radiation, and the offsite monitoring and public safety program. Activities and findings of the program were published in annual reports and in the monthly PHS journal, Radiological Health Data.

However, as the magnitude and frequency of releases of radioactivity from the test site became less, particularly after the Limited Test Ban Treaty went into effect in 1963 requiring all nuclear tests to be conducted underground, the offsite monitoring and public safety program became less visible. Residents of remote ranches and other small settlements were aware of the continuing program and of the monitoring personnel in their area before and during each test whether or not an accidental release occurred, but residents of the towns and cities seemed less aware of the safety program and less concerned about nuclear testing.

During the 1970's, only one underground test, the Baneberry event of December 18, 1970, released significant amounts of radioactivity to the off-site area. Only two seeps of noble gasses occurred that could be detected in the offsite area, one in 1971 and one in 1980 (U.S. Department of Energy, 1982).

Also during the 1970's, the Three Mile Island reactor accident occurred. In news reports of the accident, the fact of the minor release of radioactivity was overshadowed by what seemed to be a real-life dramatization of the current movie, "The China Syndrome" (Rogovin and Frampton, 1980).

During the same period, numerous suits against the U.S. Government were filed by long-time residents of Nevada, Utah, and Arizona, claiming that cancers they or members of their families had developed were caused by radioactive fallout. So-called atomic veterans also filed claims or suits contending cancer was caused by their exposure to radiation from nuclear weapons tests. Various claimants contended that they were forgotten guinea pigs, that the Government had done nothing to protect their health and welfare, and that data on fallout exposure were falsified or suspect. Publicity attendant to these events raised public anxiety and propagated misinformation that intensified the anxiety and fear.

THE COMMUNITY MONITORING CONCEPT

Following the Riola event of September 1980 when a small amount of noble gasses was released offsite, it became evident that citizens and officials in the more distant offsite communities were quite unaware of the continuing program of offsite radiation monitoring. In this climate of public opinion, the Department of Energy's Nevada Operations Office (DOE) and the Environmental Protection Agency's Laboratory at Las Vegas (EPA) believed that they must take steps to make the offsite radiological safety program more visible and that a non-Federal watchdog on the program might make the data obtained more credible to the local populace.

Both DOE and EPA had been involved in a citizens' monitoring program instituted in the vicinity of the Three Mile Island reactor in 1980 during the time when radiokrypton was purged from the reactor containment building. The program was a response to local officials in the TMI area who sought State and Federal aid to purchase radiation monitoring instruments that their municipalities could use to independently monitor environmental radiation during the purge (Reilly 1980; Baratta et al., 1980).

For that program, local officials nominated residents as citizen monitors, and State and Federal participants selected the monitors from these nominees. DOE and EPA provided detector/recorder systems that would continuously measure beta and gamma radiation exposure. Citizen monitors were trained by Pennsylvania State University, and the Pennsylvania Department of Environmental Resources Bureau of Radiation Protection (DER) provided technical direction. Citizen monitors independently analyzed the data they collected daily and reported it to their own communities and to the DER. The DER checked, analyzed, and reported the data to news media. The 12 community monitoring stations managed by local citizens did much to reassure residents of participating communities that radiation levels were being measured and truthfully reported by industry and government.

The apparent success of the program at Three Mile Island led EPA and DOE to attempt an expanded program of community monitoring in the environs of the Nevada Test Site. The Community Monitoring Program was instituted as a joint project between two Federal agencies (the EPA and the DOE), two State agencies (the University of Nevada and the University of Utah), and 15 communities (11 in Nevada, 3 in Utah, and 1 in California).

RESPONSIBILITIES OF PROGRAM PARTICIPANTS

The Health Physics Division of DOE's Nevada Operations Office and the Nuclear Radiation Assessment Division of EPA's Environmental Monitoring Systems Laboratory--Las Vegas together designed the program. It was to comprise a network of community monitoring stations with state-of-the-art equipment that would be an integral part of the offsite radiation safety program that EPA and its predecessor had conducted for DOE for 27 years. Another major objective was to enhance visibility and credibility of the offsite program by eliciting direct community involvement.

Fifteen population centers close to the Nevada Test Site, or those where knowledge and understanding of the program were important to allay fear of Government neglect or health effects from fallout, were selected as community participants. Seven of the communities selected already had active air sampling stations for the offsite program, and four of these also had samplers for noble gases in air and for tritium in atmospheric moisture. Five of the other communities selected had standby stations in EPA's offsite program. Two of the remaining communities had active stations nearby, and only 1 of the 15 communities selected required a completely new setup. Locations of the 15 communities are shown on the map in Figure 1.

The DOE, as the agency with ultimate responsibility for public safety during nuclear testing operations, was to provide overall management oversight of the program and would provide financial support to program participants. Two contracts were let: one with the Desert Research Institute of the University of Nevada, and another with the Nuclear Engineering Department of the University of Utah. DOE also provided incremental funds to EPA for purchase of additional equipment needed for the community stations. DOE provides funds to operate the total offsite radiological safety program under its interagency agreement with EPA.

The Desert Research Institute (DRI) was to negotiate with each community for a suitable station location and for electrical power service to it. DRI would interact with local officials in selecting and employing the local station managers and would maintain close liaison with the managers to provide administrative management and direction. DRI would also assist station managers in arranging and publicizing community meetings, make arrangements and handle logistics for their training, and assure that data from the program would be disseminated to the communities through the local managers. DRI was also to develop and manage a quality assurance program and provide statistical analysis of the data as an independent check on EPA, and would publish quarterly reports of their findings.

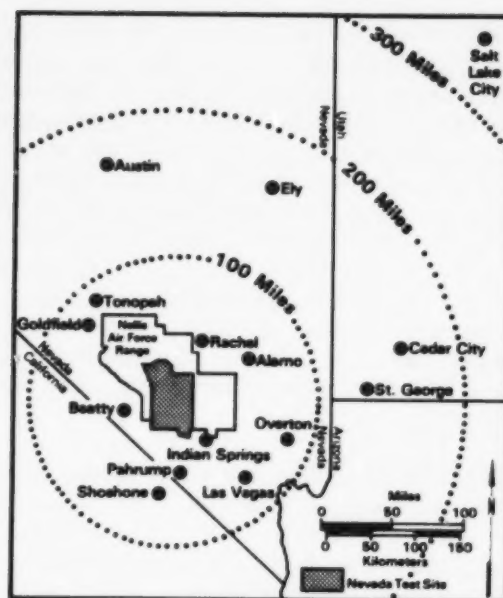


Figure 1. Community Monitoring Network station locations.

Under its contract with DOE, the University of Utah (UU) was to provide training of station managers. This training obligation included an initial intensive course of instruction for all managers as well as periodic refresher courses, training of replacement managers, and providing training aids that the managers could use in teaching local assistants to perform the station manager's routine duties during a manager's absence. Also, the UU was to assist in developing visual aids the managers could use in illustrating talks they would give to local groups.

EPA was to provide technical direction for the program. EPA would select and acquire the instruments to be used at the stations; calibrate, install, and maintain them; visit each station on a weekly schedule to collect samples and records; analyze the samples and interpret radiochemical as well as dosimetric data; and include findings from the Community Monitoring Network as well as from all its other offsite surveillance networks in its regular annual report. EPA was also to provide technical guidance to station managers as problems were identified and during the training and refresher courses.

Each community was to nominate a local resident, preferably one with some science background or training, who would provide day-to-day operation of the station and serve as an effective liaison between the community and the nuclear testing organization. Also, each community was to provide advice on suitable space for the station.

The station managers selected include two University professors (one in Las Vegas and one in Salt Lake City) who involve students in station operation. Nine are high school science teachers. Two manage retail stores, one is a retired science teacher who owns and manages a television repair shop, and one is a county water district employee. In the first year of the program's operation, one manager resigned and was immediately replaced and another became a station co-manager, sharing responsibilities with a colleague at the high school where both teach. All station managers are part-time employees of the DRI. They are paid a monthly stipend and receive per diem during the time they are attending training sessions. Also, all are expected to have their families participate in EPA's Human Surveillance Program, visiting the EPA's Las Vegas Laboratory twice a year for measurement of the radioisotopes in their body tissues (their body burdens) by whole-body and lung counting of gamma activity.

The space provided by the communities was selected to make the stations readily noticeable to residents. Power had to be available or able to be brought to the space provided. Also, the bright lights to remain on the stations at night were a consideration. In two communities, space was provided on the grounds of the university campuses. Six communities provided space on the grounds of the local high schools. Two found space on county property near the local sheriff's offices. One station was located on the grounds of the community center, one was at a county park near the area swimming pool, and one was on county property along the main street of town. Two were located on private property, one near a bank, and one near the town's only store. Although some locations were more visible than others, all were readily accessible to residents.

MONITORING EQUIPMENT AND STATION SETUP

Each station is equipped with three kinds of air sampler, two systems for direct measurement of gamma radiation, and a recording barometer or barograph. Each occupies a rectangular area, lighted at night from floodlights mounted on poles at each end of an aluminum-frame equipment bench and automatically controlled by a light-sensor switch. The sampling equipment is arranged on a 10-foot long by 30-inch wide bench and the dosimetry equipment is attached to an aluminum T-shaped frame located about 10 feet from one end of the bench. Both bench and T-frame are set in concrete, and both allow radiation detectors and sampling ports to be 1 meter above ground. The arrangement of equipment is illustrated in Figure 2.

Affixed to the front edge of the bench, facing the approach to the station, are two signs. One explains what the station is and gives the name and phone numbers of the station manager in that community. The other is a diagram of the station that identifies each piece of equipment. After several months of experience with the stations, a weather-tight box was added in which to store tools, supplies, and air samples awaiting pickup by EPA personnel. In February 1983, a locking, glass-fronted, aluminum display case was added to each station. In this case, managers display a statement of findings from the station and a graph of average daily gamma exposure rate for the past week. Both are provided weekly by EPA.

In April 1981 the first station was installed on the campus of the University of Nevada at Las Vegas, on which the EPA Laboratory is also located. This station served as a prototype for 4 months before installation of the other stations was begun. All but one of the stations had been installed by the end of January 1982, despite the difficulties EPA personnel encountered in pouring concrete during sub-freezing weather in some communities. The station in Austin, Nevada, was not completed until late April of 1982 due to delays in installing a power line to the station during winter months.

In the following sections, the operating characteristics, sampling or measurement frequency, sensitivity, and calibration of each piece of monitoring equipment are described. Also described are problems encountered by station managers in day-to-day operation of the stations and the equipment modifications made to correct those problems.

AIR SAMPLING EQUIPMENT

Particulates and Reactive Gases

Each station has a RADECO HD-28A air sampler that samples air at a constant flow rate of 2 cubic feet per minute (cfm) through a 2-inch diameter

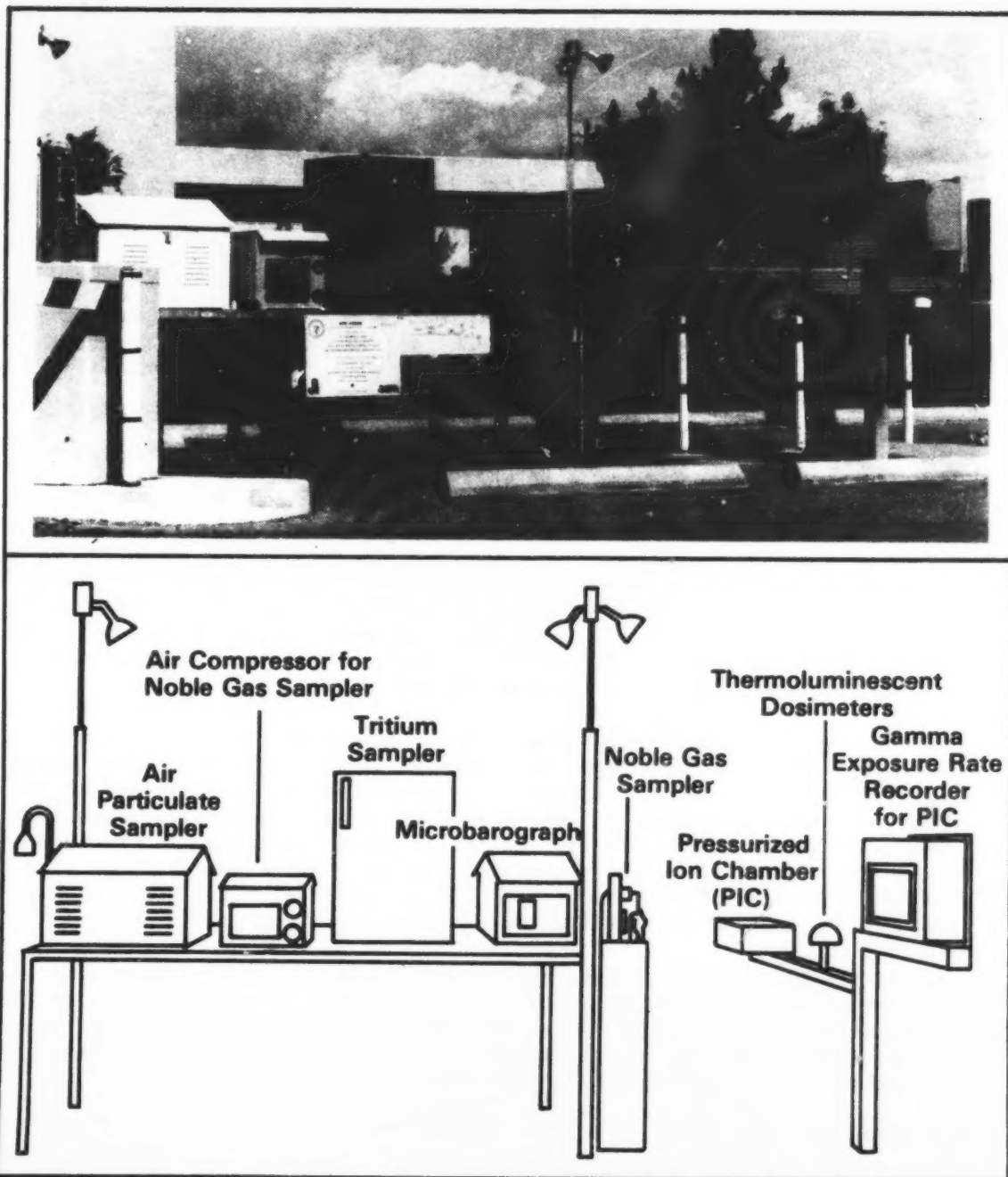


Figure 2. A typical Community Monitoring Station.

glass fiber prefilter and a 2-inch diameter cartridge of activated charcoal impregnated with triethylene diamine (TEDA) to increase efficiency for organic iodine collection. The station manager changes prefilters and cartridges each Monday, Wednesday, and Friday and packages and labels them. An EPA monitor picks them up during his routine weekly visit to each station and takes them to the Las Vegas Laboratory for analysis.

Each of the air samplers is protected from sun, rain, snow, and dust storms by being mounted in a metal weather housing. The sampling head is outside the housing, about 4 feet above ground level, and connected to the sampler vacuum pump by copper tubing, as can be seen in Figure 2.

The RADeCO samplers were calibrated by the manufacturer to a standard traceable to the National Bureau of Standards (NBS) before shipment. They are recalibrated to the constant flow rate of 2 cfm by means of a venturi-type portable calibrator designed and manufactured by RADeCO and calibrated against an NBS standard by the manufacturer. Recalibration is performed every 6 months and after any preventive maintenance or repair is performed on a sampler.

The particularly harsh environmental conditions to which the samplers are subjected, with temperatures ranging from above 120°F. to below 0°F. caused the plastic rotameters to crack and break at the flow adjustment screw and thus indicate a false flow rate. The rotameters were therefore replaced with Dwyer model rotameters.

The elapsed time indicator, also made of plastic, did not long withstand resetting three times a week, every time the filters were changed. These plastic indicators were thus replaced with a Kramer-type timer made of metal. Also, the plastic jar in the exhaust muffler assembly did not withstand the extreme summer heat and was replaced in each sampler with a glass jar.

Tritium in Atmospheric Moisture

Atmospheric moisture is collected by a sampler designed and built by Nuclear Radiation Assessment Division personnel at the EMSL-LV. An aquarium aerator pump pulls air through a Union Carbide 5A molecular sieve containing 1/8-inch to 3/16-inch pellets. The sampler collects water from up to 10 cubic meters of air during a 7-day sampling period. A prefilter at the air intake removes particles before the air passes through the sieve. A thermograph and rotameter allow calculation of sample volume.

The molecular sieve column, with thermograph, rotameter, dry gas meter, and aerator pump, are mounted in a 2.5-cubic-foot refrigerator to maintain uniform temperature during the sampling period. The air intake and exhaust are located outside the refrigerator, connected to the column with tubing. The entire assembly is mounted on the metal bench as shown in Figure 2.

During his weekly visit to each Community Monitoring Station, the EPA monitor replaces the molecular sieve column containing the moisture sample with a fresh column. At the Laboratory in Las Vegas, the moisture is recovered and analyzed for tritium.

Calibration of the dry gas meter in each sampler is performed every 6 months. Calibration is against a wet test meter.

Noble Gases

An Air Products cryogenic air sampler system is used to collect an air sample in liquid form, from which noble gases can be fractionally distilled in the laboratory. The system consists of a filter-dryer assembly connected to an evacuated sample bottle housed in a liquid nitrogen dewar. Air, passing first through the filter-dryer assembly to remove particles, moisture, and carbon dioxide that could freeze the inlet line, moves into the sample bottle at a constant flow rate. Flow rate is regulated by a limiting orifice at the ambient air intake and depends on the orifice size. To maintain the nitrogen in liquid form, a compressor module is linked to a refrigerator, or expander module, in the top of the dewar. Liquefaction of the sampled air maintains negative pressure in the sample bottle, and the flow continues at a constant rate over the 7-day sampling period.

Each week, the EPA monitor replaces the dewar and sampling bottle containing the liquified air sample with a freshly filled dewar and evacuated sampling bottle. He carries with him a spare tank of liquid nitrogen with which to top off the dewar, which is sometimes necessary during hot weather. Also, the sample bottles and dewars are covered during transport to minimize liquid nitrogen evaporation. The samples are brought to the Las Vegas Laboratory for fractional distillation of noble gases and recovery of krypton and xenon, which are analyzed for radioactivity. Volume of the sample is determined by weight, so no flow-rate calibration is required.

Experience in using the cryogenic sampling system showed that some modifications were required for its reliable operation in extreme weather. A gauge cover was installed on the compressor module to protect it from direct sunlight. A direct-reading vacuum gauge was installed on the expander to provide a visual indicator of the actual pressure in the dewar during operation of the refrigeration system.

The calibrated brass capillary orifice provided by the manufacturer often became plugged and had to be replaced. The prohibitive cost of these orifices led EPA to design and construct a far less expensive forged-needle metering valve system to replace the calibrated orifice. The metering valve was installed on each sample bottle. The valve is adjusted to allow a flow rate of between 80 standard cubic centimeters (scc) and 100 scc per minute, depending on the location and altitude of the station where it is operating. The EPA monitor checks flow rate with a rotameter before and after sample bottles are changed. The set flow rate provides a total sample volume over a 7-day period of up to 1.5 cubic meters of air. The minimum volume required for analysis is approximately 0.25 cubic meters.

DOSIMETRY EQUIPMENT

Integrated Gamma Radiation Exposure

At each Community Monitoring Station, three Harshaw Model 2271-G2

thermoluminescent dosimeters (TL-200's) are placed in a secured plastic housing, referred to as a "birdhouse," located 1 meter above ground to standardize exposure geometry. Each dosimeter contains two small "chips" of dysprosium activated calcium fluoride mounted in a Teflon window and attached to a small aluminum card. An energy compensation shield of 1.2-mm thick cadmium metal is placed over the card bearing the chips, and the shielded card is sealed in an opaque plastic holder. With three such holders at each station, six readings of total gamma radiation exposure are obtained. The dosimeters are exchanged and read quarterly.

The TL-200 dosimeters are almost uniformly sensitive to photons of 100 kiloelectron volts (keV) and higher energy. The smallest exposure increment above background radiation that they can measure depends primarily on the magnitude of background variation. Natural background at the 15 Community Monitoring Stations ranges from 15 milliroentgens (mR) to 35 mR per quarter, depending mainly on altitude and composition of the earth's surface at each location. Typically, the smallest change in exposure detectable at the 99 percent confidence level for a 90-day exposure is between 1 and 5 mR above background.

Gamma Radiation Exposure Rate

Each station has a pressurized ion chamber (PIC) detector/recorder system. It provides a continuous direct measure of gamma radiation exposure rate. The PIC is the only instrument at the stations that residents can look at whenever they wish to get an immediate reading of radiation exposure rate.

The PIC system is a modified Reuter Stokes RSS-1011 radiation monitoring system. Each consists of a low-range pressurized ion chamber detector that will measure exposure rates of 0 to 100 milliroentgens per hour (mR/h) connected to a remote processor unit. This unit contains circuitry, power supplies, recording and display devices, and an 8-bit microcomputer. In the standard Reuter Stokes system, the microcomputer directs transmission of data to a central data collection and processing center. In the system acquired for the Community Monitoring Stations this communicating function is replaced with a magnetic tape recording system.

One other modification was made in the basic system. A large window of clear plexiglass was installed in the hinged cover of the remote processor unit housing to make the readout systems visible without opening the housing. There are three readout systems. Two of these can be immediately seen and read by local residents. One is a digital display of the exposure rate in microroentgens per hour (μ R/h) or mR/h depending on the automatically selected range, and the other is a paper strip chart on which the gamma exposure rate is recorded by a dot every 2 seconds. Readings are in four ranges that are indicated on the strip chart by an auxiliary chart trace (broken line): 0 to 50 μ R/h, 0 to 500 μ R/h, 0 to 10 mR/h, and 0 to 100 mR/h. The third readout is the magnetic tape record which must be removed and read into a computer at the laboratory. Exposure rate is recorded on the magnetic tape every 5 seconds.

The low-level sensor has a sensitivity ranging from 0.81 to 1.56 for photons of 70 keV up to at least 8 million electron volts (MeV) relative to a sensitivity of 1.00 for 4 MeV photons. It is calibrated against cobalt-60 by the manufacturer, who reports a calibration accuracy of better than ± 4 percent and a calibration drift of less than 2 percent per year (Reuter-Stokes, Inc., 1981).

On his weekly visit to each station, an EPA monitor removes the 7-day paper strip chart record and exchanges the magnetic tape cassette record with a fresh tape. The local station manager examines the system daily, inserts a new roll of chart tape as necessary, and reports any operational problems to the EPA Laboratory. During power-line failures, the system automatically converts to 12-volt battery power and will operate for 8 hours in that mode. The 12-volt battery is recharged by an internal battery charger when power is restored. That battery is replaced annually. A 300-volt dry cell used for ion chamber bias is not rechargeable. It is replaced as necessary, about every 3 months.

MICROBAROGRAPH

Natural background varies with atmospheric pressure, and a record of this pressure was desired at each station. Because of the weather extremes encountered in the network of Community Monitoring Stations, and because the stations are not constantly attended, a marine barograph, designed to maintain its precision through the varied conditions encountered by ships at sea, was selected. The particular instrument is Federal Stock Number 6660-946-9632, available from the Belfort Instrument Company. The instrument has a 2.5 to 1 magnified scale, high sensitivity and accurate temperature compensation. These earn it the title of microbarograph.

The chart drive mechanism is an 8-day, spring-wound clock which drives the cylinder at a rate of one revolution in 108 hours. The charts are marked for a pressure range of 965 to 1050 millibars. They are changed by the EPA monitor during his weekly visit and brought to the Laboratory where they aid in interpreting gamma exposure rate records. The station managers ensure that the barographs are operating, add ink or adjust the recording pens as necessary, and report problems promptly to the EPA.

HAND-HELD SURVEY METERS

In November 1982, EPA provided each station manager with two hand-held radiation survey instruments. One was an Eberline E-500B Geiger-Mueller survey meter with a beta/gamma probe; the other was a Baird Atomic scintillator, model NE148A, suitable for measuring low-level gamma radiation and X rays. With the instruments, managers received a Coleman lantern mantle to use as a radiation source with which to determine that the instruments are operating.

When the instruments were issued, each manager received personal instruction in their proper use from the EPA personnel who delivered them. This training was reinforced at a session in the refresher course managers attended in Las Vegas in December 1982. At the refresher course, each manager received a written and illustrated standard operating procedure for the instruments. Also, they were briefed on the routine calibration and preventive maintenance procedures to which the instruments are subject. These procedures are the same as those used for instruments the EPA monitoring personnel carry, and every 90 days the station managers' instruments are exchanged for newly recalibrated and maintained instruments.

Station managers use their survey instruments to check alleged radiation sources reported by residents to be in the community. Several managers have found the instruments useful for classroom demonstrations of natural radioactivity and variations in natural background. Also, should there be a release of fission products from the Nevada Test Site, station managers could use their instruments to assist EPA monitoring personnel in measuring and documenting beta and gamma radiation exposure rates in and around the communities affected.

NETWORK COSTS

Most of the equipment installed in Community Monitoring Stations was already in use or scheduled for purchase to replace older equipment in the offsite monitoring networks. Therefore, incremental costs to cluster the air samplers and dosimetry equipment in 15 Community Monitoring Stations was relatively small.

The average cost of equipping 1 station in the 15-station network was approximately \$32,000. This includes two dewars for each noble gas sampler and the prorated cost of four complete extra sets of equipment as replacements and backup to the network. Additional funds were spent on labor and travel to select the sites, obtain power, and work with local officials to select the station managers.

RELATIONSHIP TO OTHER MONITORING NETWORKS

Although the Community Monitoring Stations themselves form a unique monitoring network, almost all the equipment at these stations are part of other routine networks operated by the EPA Laboratory in the offsite area surrounding the Nevada Test Site. Only the microbarograph is unique to the Community Monitoring Network.

The RADeCO air samplers are part of a network of 30 continuously operating stations in Nevada, Utah, and California for sampling airborne particulates and reactive gasses. In addition, there is a network of 72 standby air sampling stations throughout the western States. These are now equipped with Gelman Tempest samplers but will be converted to the RADeCO-type samplers in fiscal year 1983.

Noble gas and tritium samplers are operated routinely at one additional small community close to the Test Site boundary, giving that network a total of 16 stations. Temporary stations can be added by EPA personnel should there be a seepage of noble gases from an underground nuclear test operation.

A dosimetry network comprises 81 stations in Nevada and surrounding States, including the 15 Community Monitoring Stations. All have the same "birdhouse" containing six TLD chips. Also, some 46 local residents of the offsite area, including the 15 Community Monitoring Station managers, routinely wear TLD badges, which are exchanged and read monthly.

The exposure rate recorder network comprises 22 stations including the 15 Community Monitoring Stations. Three of these locations are equipped with solar-powered PIC systems. Also, EPA monitors carry portable PIC systems to be set up downwind of the Nevada Test Site should there be an accidental release of radioactivity from testing operations there.

Finally, the EPA has a Human Surveillance Program in which selected families visit the Las Vegas Laboratory twice a year. On each visit their radiation body burdens are determined and once a year they receive a physical examination, also. Families of the Community Monitoring Station managers are among the 34 offsite families now actively participating in this continuing program.

Thus, the Community Monitoring Network can, but does not, stand alone. Its stations serve double duty as stations in the several routine networks EPA maintains to monitor environmental radiation trends in the offsite area as well as compliance with the guidelines for public radiation safety during nuclear testing operations.

ANALYTICAL METHODS AND DATA INTERPRETATION

As each monitoring system at the Community Monitoring Stations is part of another routine offsite monitoring network, samples and dosimetric measurements from the Community Monitoring Stations are analyzed by the same methods used for samples and measurements from the other networks. Analytical methods are described in detail by Johns et al. (1979) in "Radiochemical Analytical Procedures for Analysis of Environmental Samples." Also, each monitoring system is subject to the applicable monitoring network quality assurance plan described in the offsite environmental monitoring report published annually by the EPA Laboratory (Black et al., 1982).

Public health implications of radioisotopes detected in air samples are determined by comparing the measured amount of each isotope to the Concentration Guides specified by DOE Order 5480.1, Chapter XI. These Concentration Guides are annual average air concentrations. They are one-thirtieth of the maximum permissible concentrations recommended by the International Commission on Radiation Protection (ICRP) for continuous (168 hours per week) occupational exposure. The maximum permissible concentrations specified by the ICRP could be present in air continuously for a radiation worker's entire worklife without causing discernable biological effect in the workers breathing that air. The maximum permissible concentration is divided by 30 to obtain the Concentration Guide to protect any unusually sensitive person in the general population.

AIR SAMPLES

Particulates and Reactive Gases

Prefilters from the RADeCO air samplers are analyzed by gamma spectrometry. Intrinsic germanium (IG) or lithium-drifted germanium [Ge(Li)] detectors are used with a multichannel gamma pulse height analyzer calibrated at 0.5 kiloelectron volts (keV) per channel from 0.04 MeV to 2 MeV. Efficiencies of the detectors depend on the gamma energy, but are about 4 percent for the 0.662 keV gamma photons from cesium-137. Counting* time for each filter is 30 minutes. The minimum detectable concentration by this method is about 0.04 picocuries (pCi) for a single radioisotope per cubic meter of air. (Since a picocurie is 2.2 radioactive disintegrations per minute, the minimum detectable concentration is about 0.088 disintegrations per minute in 35 cubic feet of air.)

*Counting refers to enumerating the radioactive disintegrations per unit of time.

This detection limit allows measurement of iodine-131 concentrations in air that are 0.12 percent of the Concentration Guide. It enables measurements of other gamma emitting fission products at concentrations in air that are even smaller percentages of the Concentration Guides for those fission products. For example, the detection limit of 0.04 pCi/m³ is 0.024 percent of the Concentration Guide for cesium-137.

Spectral data are resolved by an on-line computer program that identifies every peak in the spectrum and quantifies the concentration of isotopes of beryllium, zirconium, niobium, molybdenum, ruthenium, iodine, tellurium, cesium, barium, lanthanum, and cerium. Should other isotopes be identified in the spectrum, they would be quantified by special techniques.

Three of the Community Monitoring Stations participate in a gross beta activity study begun for the Air Surveillance Network in July 1980 to detect trends in atmospheric radioactivity more quickly than is possible with gamma spectrometry. The three stations are those at St. George, Las Vegas, and Shoshone. Two other stations from the Air Surveillance Network, north and east of the Nevada Test Site, are also part of the study (Black et al. 1982). Gross beta activity in each of the prefilters from these stations is determined by counting for 30 minutes in a low-level, end-window, gas-flow proportional counter. Counting is done at least 5 days after sample collection to allow natural radon and thoron daughter products to decay. This procedure provides a detection limit of about 0.5 pCi of total gross beta activity per sample.

Following gamma spectral analysis, and also gross beta counting for the Las Vegas samples, prefilters from Rachel, Indian Springs, and Las Vegas are composited and any plutonium present is isolated by radiochemical procedures using acid digestion and anion-column separation. The recovered plutonium is analyzed for plutonium-239 by alpha spectrometry with a counting time of 1,000 to 1,400 minutes. The detection limit for plutonium-239 by this method is about 5 to 10 attocuries of plutonium per cubic meter of air. Ten attocuries is 0.003 percent of the Concentration Guide for plutonium-239. (An attocurie is one one-millionth of a picocurie.) Plutonium concentrations in prefilters from the three Community Monitoring Stations near the Nevada Test Site are compared with plutonium concentrations determined by the same procedures in prefilters from eight distant stations in the Standby Air Surveillance Network. If this comparison should show a trend toward increasing concentration in samples from close-in stations relative to those from the distant stations, potential local sources of the increased plutonium, including the Nevada Test Site, would be investigated.

The charcoal cartridges are designed to collect reactive gases. These are mainly gamma-emitting radioisotopes of iodine found in fresh fission products, so under normal conditions little if any radioactivity is expected. Therefore, four cartridges from each station are composited and together screened for gamma emitters by counting for 10 minutes using a thallium activated sodium iodide [NaI(Tl)] detector and multichannel analyzer. If any gamma energy peak from a man-made radioisotope is discerned in the spectrum, each of the four cartridges is analyzed separately by the gamma spectrometry method described for the prefilters.

Tritium in Atmospheric Moisture

Tritium is measured in the atmospheric moisture collected by the molecular sieves at each Community Monitoring Station. The moisture is removed from the molecular sieve by heating and collected in another moisture trap cooled by liquid nitrogen. The water collected is weighed and then distilled. Four milliliters of the water sample, containing the tritium, is dissolved in a scintillation cocktail. (The cocktail is a solution of organic substances that emit light after absorbing energy from the tritium beta radiation.) The sample is allowed to adapt to the dark for 3 days and then is counted for 50 minutes in a liquid scintillation counter. About 400 picocuries of tritium per liter of water is the minimum concentration of tritium detectable by this method. The minimum amount detectable per cubic meter of air depends on the relative humidity of the air during the week it is being collected, and this varies from week to week and from one location to another.

Noble Gases

The liquid air collected by the cryogenic samplers is weighed to determine sample size. It is then fractionally distilled by a method of gas chromatography that takes advantage of the different temperatures at which the constituent gases are liquified. The krypton and xenon fractions are separately dissolved in scintillation cocktails of toluene. After dark adaptation, each is counted for radiokrypton or radioxenon. With an original air sample of 0.4 to 1.0 cubic meters, the minimum concentration detectable is 4 pCi/m³ for krypton-85, xenon-133, and xenon-135 at the time of counting. This is 0.012 percent of the Concentration Guide for xenon-135.

Findings

Since the Community Monitoring Stations began operation, the only gamma emitting radioisotope detected in air is beryllium-7. Beryllium-7 occurs naturally world wide. It is produced by cosmic radiation interacting with nitrogen and oxygen in the air. Although it is not strictly appropriate to apply a Concentration Guide to a naturally occurring isotope, beryllium concentrations detected in the prefilters have been less than 0.1% of the Concentration Guide for that isotope. No reactive gases have been detected in the charcoal cartridges collected from Community Monitoring Stations since the stations began operation.

Most samples of atmospheric moisture collected from the Community Monitoring Stations to date contain less than the minimum detectable concentration of tritium. Of the few samples in which tritium could be measured, none contained concentrations greater than 0.1% of the Concentration Guide.

No radioactive xenon has been detected in any of the cryogenic air samples from the Community Monitoring Stations, but all have contained some krypton-85 at levels consistent with worldwide radiokrypton activity. The maximum concentration of krypton-85 in any sample has been less than 0.1% of the krypton-85 Concentration Guide.

Specific data from the air samplers at the Community Monitoring Stations and from the gross beta activity and plutonium studies associated with the Air Surveillance Network will be published in the 1982 "Offsite Environmental Monitoring Report." Gross beta activity and plutonium concentrations are consistent with the low levels found nationwide and are attributable to worldwide fallout.

DOSIMETRY

Integrated Gamma Radiation Exposure

After one-quarter year (3 months) of exposure at a Community Monitoring Station, the TL-200 dosimeters are exchanged and brought to the Las Vegas Laboratory where they are read in a Harshaw 2271 automated TLD reader. The reader heats the radiation-sensitive chips, which then give off light proportional to the gamma radiation they absorbed. The light is converted to an electrical signal which is interpreted by a computer and printed as the total exposure in milliroentgens. Thermoluminescent dosimeters worn by the station managers are exchanged and read in the same way.

Gamma Radiation Exposure Rate

Paper strip charts and magnetic tape cassette records of gamma exposure rate made by the pressurized ion chamber (PIC) system at each station are collected weekly and brought to the Las Vegas Laboratory. The paper strip chart records are examined visually, and any anomalies are noted. Photocopies of the portions of the record containing an anomaly are made as a permanent record, and the original strip chart is returned to those station managers who want them for reference or display in the community.

Exposure rate data from the magnetic tapes are transferred through a minicomputer to permanent computer storage, from which they may be retrieved as desired. The minicomputer averages the data collected on the tape every 5 seconds to obtain hourly averages for each day. It also obtains a daily and a weekly average exposure rate and calculates a standard deviation for each average. The computer is programmed to print the hourly averages for each day in tabular form and as a graph of gamma exposure rate versus time. It also prints the daily averages in tabular form and as a graph showing the average exposure rate for each day versus date.

Findings

The total gamma radiation exposure measured by the TLD's is compared to valid measurements of natural background exposure made during the past year at the same location or a similar nearby location. Background here refers to the gamma radiation exposure from cosmic radiation and naturally occurring radioisotopes plus any contribution from residual manmade fission products, such as worldwide fallout. TLD's from all the Community Monitoring Stations have been within the normal range of background.

Total gamma radiation exposure determined by TLD badges worn by a station manager is compared to the background measured at the Community Monitoring Station in his or her community. Any net increase above station background is reported to the station manager and the source of the net increase is investigated if the manager wishes. For example, a volunteer with an appointment to have bite-wing X rays taken by his dentist wore TLD badges in his shirt and pants pockets while at the dentist's office. Neither badge received an exposure from scattered X rays that would show in a quarter-year exposure. The few net exposures reported have been low. Most have been less than 5 mR above background, which is the upper range of the detection limit at a 99 percent confidence level.

Increases in gamma exposure rate recorded by the PIC systems have been associated with weather fronts moving through a station's area. These are small increases, usually of a few hours' duration. Reduced barometric pressure, which can be verified by the barograph records, allows more natural radon and thoron to enter the air from the earth and rock, and the daughter products of radon and thoron decay account for the slightly increased gamma radiation exposure rate observed. Precipitation and snow cover also cause slight changes in the gamma exposure rate.

The background radiation levels recorded by the PIC's are consistently about 23 percent higher than that measured by the TLD's. This difference may be attributed in part to the wider range of gamma energies to which the PIC detector is sensitive. The difference will be further investigated during the next several months.

PUBLIC INTERACTION AND REPORTING

TOWN HALL MEETINGS

Enhanced visibility and understanding of the offsite radiation monitoring and public safety program by offsite residents was a major program objective. Therefore, a series of "town hall meetings" to be held in the participating communities during the first year of station operation was incorporated into the Community Monitoring Program design. The meetings were intended to introduce the Community Monitoring Station and its manager to the community, provide background information on the nuclear testing program and its associated safety programs, explain the role of each participating agency, and obtain feedback from local residents who would be encouraged to ask questions and express their concerns.

The Desert Research Institute (DRI) arranged the meetings in cooperation with the station manager in each community. In cooperation with the DOE Public Affairs Office, the DRI also arranged to publicize the meetings. They provided handbills for the station manager and EPA monitors to distribute, placed paid advertisements in local newspapers, encouraged news stories about the new stations and the meetings, and arranged for public service announcements on radio whenever possible. All were weekday evening meetings beginning at a time considered most convenient for the community.

The first such meeting was held at the Community Center in Pahrump, Nevada, on February 3, 1982. The agenda called for the local station manager to open the meeting and introduce the guest speakers. These, in the order they spoke, were:

- the Manager of the DOE's Nevada Operations Office, who explained why and how nuclear tests are conducted and showed a 30-minute film illustrating the preparation for and conduct of an underground nuclear test and the associated safety programs,
- the Director of the EPA Laboratory's Nuclear Radiation Assessment Division, who explained the history and current operating procedures of the offsite radiation monitoring and public safety program,
- the Director of the DRI's Water Resources Center, who explained the objectives of the new Community Monitoring Program and the role of the two State universities in it, and
- the station manager, who explained the equipment at his station and his own role in the program.

Most used slides to illustrate their talks. The series of speakers was followed by a question-and-answer period and refreshments. The formal part of the program took longer than the scheduled 1-1/4 hours, and there were many questions, which continued in informal groupings when refreshments were served. Sixteen local residents attended, not counting the station manager.

Attendance at the next two meetings in Goldfield and Tonopah, as shown in Table 1, was discouraging. Nevertheless, at critiques held after each meeting, participating Federal and State agencies agreed that the effort must be made no matter how small the attendance. At most meetings, at least one local official attended, usually the official who originally arranged for community participation. Attendees seemed interested and asked many questions, sometimes staying quite late to do so. Some expressed appreciation for the openness with which speakers explained the program and answered questions. Also, numerous handouts on the Community Monitoring Program, on related monitoring and public safety programs, on activities at the Nevada Test Site, and on other programs of the DOE, such as nuclear waste storage, were picked up and presumably read by residents attending the meetings.

Meetings were held in six more communities before the station managers gathered in Las Vegas in August 1982 for their first week-long refresher course arranged by DRI in cooperation with the University of Utah. Attendance at these six ranged from 8 in Cedar City to 37 in Alamo (see Table 1). Local press representatives attended those at Ely, St. George, and Rachel, and a Japanese television company filmed portions of the meeting in Cedar City. Some residents complained that the formal part of the meeting was too long, and with so many speakers there was not enough time, or residents were too tired, to ask all the questions they wanted to ask. With additional feedback from the station managers during their course, they and the other participants agreed on a modified format for the remaining meetings.

The new format was first used at the meeting in Beatty on September 15. The station manager opened the meeting by introducing Federal and State government participants, but only one of these, the EPA representative, made a formal presentation. A 15-minute version of the film on nuclear testing was shown, after which the EPA representative spoke for 20 minutes from an outline approved by all agencies. A series of 12 slides contributed by the agencies illustrated the Community Monitoring Network and its relationship to other offsite networks, both past and present; how station managers were selected and trained and the duties they perform; the purpose of each instrument at a station and the significance of the radioisotopes monitored; and how the routine monitoring networks are supplemented with special activities before and during each nuclear test. She called on the DOE representative to briefly answer the common question, "Why do we continue to test nuclear weapons when so many have already been tested?"

Throughout the program, the audience was encouraged to note their questions on cards handed out with pencils as people arrived. These cards were gathered at the close of the presentation. The station manager then acted as moderator for the panel of experts to answer those questions and any others from the floor. The panel comprised at least one representative from each

TABLE 1. SUMMARY OF "TOWN HALL MEETING" ATTENDANCE AND SCHEDULE

COMMUNITY	MILES FROM NTS CONTROL POINT	POPULATION*	GUESTS ATTENDING		1982 MEETING DATE
			No.	% of Population	
Pahrump, NV	49	3,500	16	0.46	February 3
Goldfield, NV	84	700	6	0.86	March 22
Tonopah, NV	105	3,600	7	0.19	April 1
Rachel, NV	51	50	29	58	April 15
Overton, NV	98	1,200	18	1.5	May 27
St. George, UT	137	11,350	14	0.12	June 9
Cedar City, UT	171	10,972	8	0.07	June 18
Alamo, NV	59	700	37	5.4	June 30
Ely, NV	175	4,882	14	0.29	July 28
Beatty, NV	47	800	20	2.8	September 15
Austin, NV	180	350	4	1.1	October 13
Indian Springs, NV	31	1,500	7	0.47	October 28
Shoshone, CA	65	250**	40	16	November 18

* From 1980 U.S. census and from EPA census in small communities.

** This number increases greatly due to seasonal influx in winter months.

participating agency, usually the top official or his deputy, and the station manager.

The 45-minute presentation format proved effective, and no further complaints about the length of the meetings or inadequate time for questions were received. The question-and-answer period usually lasted more than an hour, although some audiences needed more encouragement to open up than did others. The revised format was used for the remainder of the meetings.

Altogether, 223 residents attended the series of 13 meetings. (The populations of Las Vegas and Salt Lake City were considered too large for this type of meeting to be effective.) The number attending excludes station managers and their families, members of a speaker's family who occasionally attended, or outside groups such as the Japanese television crew.

DATA REPORTS

For each "town hall meeting" the DRI prepared a data report summarizing all air sampling data collected by the network. It showed the number of

samples collected at each station since it began operation, the number found to contain radioactivity, the activity measured, and the activity expressed as a percentage of the applicable Concentration Guide. These air data summaries reported particulates, reactive gases, tritium, and noble gases. They were updated bimonthly. The DRI is continuing these bimonthly data summaries and provides them to station managers to distribute within the communities (Cooper and Jones 1982).

Beginning in mid-May, EPA began delivering weekly printouts of data from PIC gamma exposure rate systems to each station manager for use in the community. At the "town hall meeting" in Austin, residents asked for a simpler report than the comprehensive summary provided by the DRI, so EPA developed a one-page statement typed in a format that would allow it to be displayed in the community. A typical statement is shown in Figure 3. Each station manager receives the statement for his or her community with the weekly PIC printouts. By the end of February 1983, EPA had installed at each station a glassfronted, aluminum display board. In these the managers could display the weekly statement as well as the computer plot of the daily average exposure rate for the past week. The one-page statement was also used by DRI as part of the data report handout at the remaining meetings.

The statement shown in Figure 3 reflects a policy adopted in September 1982 whereby the DRI notifies each station manager by telephone when an underground nuclear test takes place at the Nevada Test Site. This helps to keep station managers more fully aware of activities at the Test Site and lets them know of tests earlier than they would through newspaper or broadcast media reports. Also, it allows them to mark their gamma exposure rate charts with the time and date of the test so that interested residents can review the exposure record with respect to each test.

EPA prepares internal quarterly reports of data from all its offsite networks. Although these are not published, all data they contain are included in the annual "Offsite Environmental Monitoring Report," and beginning with the 1982 report, the Community Monitoring Program will be included. The annual reports are published with both EPA and DOE report numbers by which they may be obtained from the National Technical Information Service in Springfield, Virginia, or from the DOE's Technical Information Center in Oak Ridge, Tennessee. Copies of the annual reports are distributed free to State health departments of every State in which samples are collected and to the Community Monitoring Station managers as well as to EPA Regional Offices, DOE Operations Offices and numerous other Government officials.

OTHER COMMUNICATION

EPA maintains a recording telephone for station managers to call at any time of day or night to ask questions or report problems. The EPA project officer for the Community Monitoring Program or his designee interrogates the record of calls often so that response can be prompt. Station managers also have credit cards with which they can call DOE, DRI, or EPA participants in the program at work or at home free of charge. These arrangements reflect the policy of open and frequent communication among program participants and between them and the public.

RADIOACTIVITY IN AUSTIN, NEVADA

AIR SAMPLES COLLECTED AT THIS MONITORING STATION DURING THE WEEK ENDING NOVEMBER 23, 1982, SHOWED THAT THE CONCENTRATION OF RADIOACTIVE MATERIALS IN AUSTIN'S AIR REMAINS AT NORMAL BACKGROUND LEVELS.

THE PRESSURIZED ION CHAMBER (PIC) DETECTOR AT THIS STATION RECORDED THE AVERAGE GAMMA RADIATION EXPOSURE RATE FOR THE WEEK ENDING DECEMBER 14, 1982, AS 16.9 MICRORONTGENS PER HOUR. THIS IS WITHIN THE NORMAL BACKGROUND RANGE OF EXPOSURE RATE FOR AUSTIN, NEVADA. A PLOT OR GRAPH OF THE PIC'S AVERAGE DAILY EXPOSURE RATE FOR THE WEEK REPORTED IS DISPLAYED BELOW.

AN UNDERGROUND NUCLEAR TEST WITH A YIELD OF BETWEEN 20 AND 150 KILOTONS WAS CONDUCTED AT THE NEVADA TEST SITE ON DECEMBER 10, 1982, AT 7:20 A.M. P.S.T. THE TEST WAS CODE-NAMED MANTECA. NO RADIOACTIVITY FROM THAT TEST WAS DETECTED ABOVE GROUND.

A SLIGHT INCREASE IN GAMMA RADIATION EXPOSURE RATE THAT OCCURRED ON DECEMBER 13, 1982 WAS ASSOCIATED WITH A STORM FRONT MOVING THROUGH THE AUSTIN AREA. REDUCED BAROMETRIC PRESSURE ALLOWS MORE NATURAL RADON AND THORON TO ENTER THE AIR FROM THE EARTH AND ROCK, AND THE DAUGHTER PRODUCTS OF RADON AND THORON ACCOUNT FOR THE SLIGHTLY HIGHER GAMMA EXPOSURE RATE OBSERVED. PRECIPITATION CAN ALSO ACCOUNT FOR AN INCREASE IN EXPOSURE RATE BY WASHING NATURAL RADIOACTIVE MATERIAL OUT OF THE AIR AND DEPOSITING IT ON THE GROUND.

SPECIFIC DETAILED DATA OBTAINED FROM COMMUNITY RADIATION MONITORING NETWORK STATIONS ARE AVAILABLE FROM THE STATION MANAGER.

Figure 3. A typical weekly statement for display at a station.

The DRI issues a progress report as needed to which other participants contribute articles or notices. The progress report summarizes program accomplishments, announces future plans, explains solutions to problems encountered by station managers, and provides them with continuing education.

The University of Utah's Nuclear Engineering Department has prepared two scripted slide series. One is to be used as a refresher for station managers and as an aid to them in training a new manager or an assistant. It explains and illustrates in some detail the proper care and operation of equipment at the stations. The other is a collection of slides with narrative for each that covers the basic principles of radiation, radioactivity, and radiation protection, and also the scope of the Community Monitoring Program. Station managers may use this collection as a resource for developing slide talks they can present to groups in their communities.

A few station managers have given talks to civic, fraternal, service, or church groups, and all are being encouraged to do so. Several have conducted field trips for school classes to visit the local monitoring station and receive a briefing on what is being monitored and why, and on how the equipment works.

A major duty of station managers is to serve as an effective liaison between the public and the nuclear testing organization, and their interaction with the public is totally encouraged. The training and refresher course each summer, the mid-year refresher held usually during the Christmas holidays, and conducted tours of the Nevada Test Site with associated briefings on current activities there are designed to increase the managers' knowledge and allow them to discuss problems and recommend ways to better inform the public about the Community Monitoring Program and the environmental radiation it monitors.

CONCLUSIONS AND FUTURE PLANS

There is no doubt that from a technical aspect the Community Monitoring Program has been successful. For the most part, equipment runs smoothly, samples are collected on schedule, and local station managers perform their duties well. Although only background levels of radiation and radioactivity are being measured at the stations, the data are valid and reliable and obtained with instruments and methodology that are better than necessary to monitor compliance with guidelines. The Community Monitoring Stations have been successfully integrated into the various routine monitoring networks of the offsite radiological safety program, and data within each of the networks are intercomparable.

It is far more difficult to assess the degree of success in meeting the other program objectives. The objective of making the monitoring program more visible and credible was based on the belief expressed by Thomas Jefferson. He said people "...are inherently capable of making proper judgments when they are properly informed." It was hoped that receiving full factual and verifiable information in understandable terms would enable anxious residents to reevaluate their anxieties and reduce them where they are not warranted. However, no mechanism for assessing increased credibility or reduced anxiety was built into the program design.

The facts about the current nuclear testing program and the offsite radiation monitoring program, as well as the history of these programs, have been made available to residents of 13 offsite communities. In addition, experts on nuclear testing and radiation protection have been available in the communities to answer questions and respond to residents' expressed concerns. Yet in most of the communities only a small fraction of the residents wanted or were able to receive the information and opportunity offered. In a few communities, some residents frankly stated that although information about current programs might be true, the information about earlier testing and monitoring was not credible.

Certainly the monitoring program has been made more visible. Besides the obvious monitoring stations in 13 of the 15 communities (in Las Vegas and in Salt Lake City the stations are visible to those who frequent the university campuses but not to the public at large), there has been considerable publicity about the program in local newspapers. A collection in Appendix F of the Desert Research Institute's first annual report on the program (Cooper and Jones, 1982) illustrates the publicity attending the installation of stations and the community meetings.

Perhaps the best evidence of success in meeting the program's ultimate objective is anecdotal. In Cedar City, a new resident who moved there from California was disturbed by stories she heard from neighbors about friends and relatives becoming ill and dying from cancer due to fallout radiation. She expressed her concern to officials who referred her to the local Community Monitoring Station manager. He spent an hour or so with her, showing her the station and talking about the data obtained now and in the past, with the result that she decided Cedar City was in fact a safe place to live as far as radiation exposure was concerned.

In St. George, city officials were pleased with the economic boost promised by a movie company from New York that was making arrangements for a production to be filmed in the St. George area. When they later heard that the company would have to find another location because five members of the production crew refused to work in St. George for fear of being irradiated by fallout, they asked the local Community Monitoring Station manager to telephone and write to the film company to explain the radiation situation in St. George and environs to them. He called and talked with the film producer and also sent him a letter, which the producer shared with crew members. All were satisfied that there was no fallout radiation danger in or around St. George, and a month after receiving the station manager's letter, the production crew was in St. George and filming of the movie was underway. In late January 1982, the St. George Chamber of Commerce named the station manager, who is a high school science teacher, the Citizen of the Year. In honoring him at a banquet, Chamber members mentioned his role as the community's radiation monitoring station manager in which he works with the DOE and EPA and the two State universities.

In Alamo, a woman with skin cancer on her hand was told by her Las Vegas doctor that it was probably due to radioactive contamination in her gold wedding band. He had evidently heard of the several wedding bands made of gold contaminated with radium when a jeweler melted gold-clad radium needles, used several years ago for radiation therapy, into a supply of gold for making wedding rings. The woman removed her ring reluctantly, but decided to ask the Alamo station manager to check it for her. He surveyed the ring in her presence with the survey meters provided him by EPA and showed that only background radiation could be detected upon contact with her ring. She appeared satisfied that her ring was not contaminated and is wearing it again, apparently without anxiety.

Future plans call for further effort to inform community residents about the program and its findings, and to spread this awareness as much as possible into outlying communities that do not have their own Community Monitoring Station. Program participants will be seeking effective ways to do this and to provide information that residents of the offsite area want about the nuclear testing program and related public safety programs now and in the past.

An attempt will be made to encourage community newspapers, especially the weekly papers, to publish an abbreviated version of the weekly summary report. The summary statement illustrated in Figure 3 will be rewritten each week in the form of a news release for station managers to deliver to their local news editors. With the release, at least at first, will be a note to editors

suggesting that if space is at a premium, they may wish to publish the information in the form of a box score, similar to the format used by many daily papers in reporting the air pollution index for their communities.

Information about the program may also be brought to outlying communities near those that have Community Monitoring Stations by some sort of meeting held there. This will be similar to the "town hall meeting" already held. Some meetings may be arranged specifically for community leaders, such as town board members, fire and police departments, or county commissioners. Also, station managers will be further encouraged to seek opportunities to speak or to bring an Agency speaker to local civic, fraternal, and service groups. Nearly half the station managers see possibilities of incorporating their Community Monitoring Stations into a school science fair, which could bring information to interested parents as well as to students.

The DOE will continue to arrange special tours of the Nevada Test Site for offsite residents, and station managers will visit the Site during their annual training and refresher course for briefings to update them on activities there. The next course is tentatively scheduled for August 1983.

No changes in station numbers, locations, or equipment are presently anticipated. However, through continuous communication between participants and with increased feedback from residents, ideas for improving the program will be evaluated and implemented when possible. Those directly associated with the program agree, after 1 year of experience with it, that it is worthwhile. They believe that its continuation, accompanied by sensitivity to concerns of the citizens it serves, will successfully bring visibility and credibility to the data it provides.

REFERENCES

- Baratta, A. J., W. A. Jester, B. G. Gricar, M. A. Reilly, G. Eidam, and A. C. Millunzi. 1980. A Citizens' Radiation Monitoring Program for the TMI Area. In: TRANSACTIONS OF THE ANS AND ENS 1980 INTERNATIONAL CONFERENCE ON WORLD NUCLEAR ENERGY--ACCOMPLISHMENTS AND PERSPECTIVES. TANSO 35 1-676, ISSN: 003-018X. pp. 40-42.
- Black, S. C., R. F. Grossman, A. A. Mullen, G. D. Potter, D. D. Smith and J. L. Hopper. 1982. OFFSITE ENVIRONMENTAL MONITORING REPORT: RADIATION MONITORING AROUND UNITED STATES NUCLEAR TEST AREAS, CALENDAR YEAR 1981. EPA-600/7-82-061. Environmental Monitoring Systems Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Las Vegas, Nevada. 111 pp.
- Cooper, E. N., and M. A. Jones. 1982. COMMUNITY RADIATION MONITORING PROGRAM ANNUAL REPORT. DOE/NV/10162-3. Water Resources Center, Desert Research Institute, University of Nevada System, Las Vegas, Nevada.
- Johns, F. B., P. B. Hahn, D. J. Thome, and E. W. Bretthauer. 1979. RADIO-CHEMICAL PROCEDURES FOR ANALYSIS OF ENVIRONMENTAL SAMPLES. EMSL-LV-0539-17. Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Las Vegas, Nevada. 109 pp.
- Off-Site Radiological Safety Program. 1964. FINAL REPORT OF OFF-SITE SURVEILLANCE FOR OPERATION NOUGAT, SEPTEMBER 15, 1961 - JUNE 30, 1962. SWRHL-1r. Southwestern Radiological Health Laboratory, Public Health Service, Department of Health, Education, and Welfare. 123 pp.
- Placak, O. R., M. W. Carter, R. A. Gilmore, R. H. Goeke and C. L. Weaver. 1957. OPERATION PLUMBBOB, OFF-SITE RADIOLOGICAL SAFETY REPORT. OTO-57-3. Nevada Test Organization, Mercury, Nevada. 207 pp.
- Placak, O. R., M. S. Seal, J. R. McBride, R. A. Gilmore, R. L. Elder and J. S. Silhanek. 1958. OPERATION HARDTACK - PHASE II, OFF-SITE RADIOLOGICAL SAFETY REPORT. OTO-58-6. Off-Site Radiological Safety Activities, Nevada Test Organization, Mercury, Nevada. 222 pp.
- Reilly, M. A. 1980. The Measurement of Krypton-85 by a Community Monitoring Program. In: TRANSACTIONS OF THE ANS AND ENS 1980 INTERNATIONAL CONFERENCE ON WORLD NUCLEAR ENERGY--ACCOMPLISHMENTS AND PERSPECTIVES. TANSO 35 1-676, ISSN: 003-018X. pp. 60-61.

Reuter-Stokes, Inc. 1981. REMOTE STATION OPERATIONAL MANUAL, RSS-1011
RADIATION MONITORING SYSTEM. Reuter-Stokes, Inc., Cleveland, Ohio.
p. 5.

Rogovin, M., and G. T. Frampton, Jr.. 1980. THREE MILE ISLAND: A REPORT
TO THE COMMISSIONERS AND TO THE PUBLIC, Vol. I. NUREG/CR-1250, Vol. I.
Special Inquiry Group, Nuclear Regulatory Commission. p. 4.

Sanders, J. B., O. R. Placak, and M. W. Carter. 1955. REPORT OF OFF-SITE
RADIOLOGICAL SAFETY ACTIVITIES, OPERATION TEAPOT, NEVADA TEST SITE,
SPRING 1955. Public Health Service. 153 pp.

U.S. Department of Energy. 1982. ANNOUNCED UNITED STATES NUCLEAR TESTS:
JULY 1945 THROUGH DECEMBER 1981. NVO-209, Rev. 2. Office of Public
Affairs, Nevada Operations Office, U.S. Department of Energy.

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16. ABSTRACT This report describes the background and the first year of experience with a community radiation monitoring program initiated in communities surrounding the Nevada Test Site as a joint project of the U.S. Department of Energy, the U.S. Environmental Protection Agency, the University of Utah, the Desert Research Institute of the University of Nevada, and 15 communities in Nevada, Utah, and California. The report describes and discusses the equipment installed at each station, the role of each participant, methodology used to analyze samples and dosimetric measurements, and the criteria against which the results are judged as well as the special activities undertaken to foster increased awareness in offsite residents of the total offsite radiological surveillance and public safety program and to elicit feedback from them about the program and about their radiation health and safety concerns. Although only background radiation levels have been detected by the network so far, the program is considered worthwhile and will be continued.		
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